UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/750,804 | 12/29/2000 | Shiquan Wu | NTL-3.2.142/3516 | 8286 |

26345 7590 07/19/2004

GIBBONS, DEL DEO, DOLAN, GRIFFINGER & VECCHIONE
1 RIVERFRONT PLAZA
NEWARK, NJ 07102-5497

| EXAMINER | |
|---|---|
| PHUNKULH, BOB A | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2661 | 6 |

DATE MAILED: 07/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. 09/750,804 | Applicant(s) WU ET AL. | |
|---|---|---|---|
| | Examiner Bob A. Phunkulh | Art Unit 2661 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *29 December 2000*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 9-12, 20-21, 23, 26-29, and 36* is/are rejected.

7)☒ Claim(s) *2-8,13-19,22,24,25 and 30-35* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 December 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Objections*

Claims 1, 9, 11, 20, 27, and 29 are objected to because of the following informalities: correct the subject "because" to –for—or –wherein—. Appropriate correction is required.

Claim 12 is objected to because of the following informalities: there are plurality of "controllers" cited in claim 11, however, only "controller" is cited in claim 12. Correct the inconsistency. Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 9-12, 20-21, 23, 26-29, and 36 are rejected under 35 U.S.C. 102(e) as being anticipated by Heath, Jr. et al. (US 6,298,092), hereinafter Heath.

Regarding claim 1, Heath discloses an apparatus for use with an adaptive orthogonal frequency division-multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a duration, the OFDM frame having data packets and a is plurality of OFDM slots, each of the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the apparatus comprising:

a receiver that responds to receipt of the OFDM signal by making a determination as to whether time diversity or spatial diversity should be used for subsequent transmissions and transmits a feedback signal indicative of that determination, an implementation of the time diversity resulting in a better robustness to counter signal fading than if the spatial diversity were implemented and an implementation of spatial diversity resulting in an increase in a rate of data packet transfer over that if the time diversity were implemented, because the OFDM signals that are transmitted over multiple ones of the transmitters are independent of each other for the spatial diversity and correspond to each other for the time diversity (see figures 4, 5A-5B).

Regarding claim 9, Heath discloses an apparatus for use with an adaptive orthogonal frequency division-multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a

duration, the OFDM frame having data packets and a plurality of OFDM slots, each of the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the apparatus comprising

at least one controller (controller 66) configured and arranged to respond to a feedback signal (receives at the feedback extractor 80) to direct an encoder to assign constellation points to the sub-carriers in accordance with a channel condition so as to classify each of the sub-carriers into one of two groups, the encoder including a space time transmitter diversity (STTD) encoder (diversity coding 64) and a spatial multiplexing (SM) encoder (spatial multiplexing 62), the STTD encoder being arranged to encode the sub-carriers classified in one of the groups in accordance with time diversity and the SM encoder being arranged to encode the sub-carriers classified in the other of the groups in accordance with spatial diversity, an implementation of the time diversity resulting in a better robustness to counter signal fading than if the spatial diversity were implemented and an implementation of spatial diversity resulting in an increase in a rate of data packet transfer over that if the time diversity were implemented, because the OFDM signals that are transmitted over multiple ones of the transmitters are independent of each other for the spatial diversity and correspond to each other for the time diversity (see figures 3 and 6).

Regarding claim 10, Heath discloses the controller is configured to determine a modulation scheme on each of the sub-carriers based on an estimated ratio selected from a further group consisting of a carrier to interference ratio and a signal to noise

ratio (see col. 4 lines 4-8).

Regarding claim 11, Heath discloses an apparatus for use with an adaptive orthogonal frequency division multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a duration, the OFDM frame having data packets and a plurality of OFDM slots, each of the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the apparatus comprising:

controllers (the combination of receive processing unit 98; channel estimator 100, channel parameters computation 104; and selection block 106) configured and arranged to direct transmission and reception in accordance with OFDM, the controllers including those associated with the reception that are configured to responds receipt of the OFDM signal by making a determination as to whether time diversity or spatial diversity should be used for subsequent transmissions and transmits a feedback signal (feed back 118, see figure 5A) indicative of that determination, an implementation of the time diversity resulting in a better robustness to counter signal fading than if the spatial diversity were implemented and an implementation of spatial diversity resulting in an increase in a rate of data packet transfer over that if the time diversity were implemented, because the OFDM signals that are transmitted over multiple ones of the transmitters are independent of each other for the spatial diversity and correspond to each other for the time diversity, the controllers associated with the reception being

configured to direct that transmission of at least one feedback signal occur that reflects the determination, the controllers including those associated with the transmission that are responsive to receipt of the feedback signal to direct an encoder to assign constellation points to the sub-carriers in accordance with a channel condition so as to classify each of the sub-carriers into one of two groups, the encoder including a space time transmitter diversity (STTD) encoder and a spatial multiplexing (SM) encoder, the STTD encoder being arranged to encode the sub-carriers classified in one of the groups in accordance with the time diversity and the SM encoder being arranged to encode the sub-carriers classified in the other of the groups in accordance with the spatial diversity (see figures 3-6).

Regarding claim 12, Heath discloses the controller is configured to determine a modulation scheme on each of the sub-carriers based on an estimated ratio selected from a further group consisting of a carrier to interference ratio and a signal to noise ratio (see col. 4 lines 4-8).

Regarding claim 20, Heath discloses a method for use with an adaptive orthogonal frequency division-multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a duration, the OFDM frame having data packets and a plurality of OFDM slots, each of

the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the method comprising:

responding to receipt of the OFDM signal by making a determination as to whether time diversity or spatial diversity should be used for subsequent transmissions and transmits a feedback signal indicative of that determination, an implementation of the time diversity resulting in a better robustness to counter signal fading than if the spatial diversity were implemented and an implementation of spatial diversity resulting in an increase in a rate of data packet transfer over that if the time diversity were implemented, because the OFDM signals that are transmitted over multiple ones of the transmitters are independent of each other for the spatial diversity and correspond to each other for the time diversity (see figures 4, 5A-5B).

Regarding claim 21, Heath discloses making the determination based on a comparison of a channel condition with a threshold, the channel condition being based on a frequency response channel matrix that is derived from OFDM symbols (see figure 5A-5B).

Regarding claim 23, Heath discloses determining a smallest element in a diagonal of the frequency response channel matrix and basing the channel condition on the determining (col. 8 line 65 to col. 9 line 5).

Regarding claim 26, Heath discloses classifying the sub-carriers into two groups one of the two groups being indicative of time diversity and the other of the two groups being indicative of spatial diversity, determining a modulation scheme on each of the classified sub-carriers based on an estimated ratio selected from a further group consisting of carrier to interference ratio and signal to noise ratio (see figures 3, and 6).

Regarding claim 27, a method for use with an adaptive orthogonal frequency division-multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a duration, the OFDM frame having data packets and a plurality of OFDM slots, each of the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the method comprising

responding to a feedback signal to direct an encoder to assign constellation points to the sub-carriers in accordance with a channel condition so as to classify each of the sub-carriers into one of two groups, the encoder including a space time transmitter diversity (STTD) encoder and a spatial multiplexing (SM) encoder, the STTD encoder being arranged to encode the sub-carriers classified in one of the groups in accordance with time diversity and the SM encoder being arranged to encode the sub-carriers classified in the other of the groups in accordance with spatial diversity, an implementation of the time diversity resulting in a better robustness to counter signal fading than if the spatial diversity were implemented and an implementation of spatial

diversity resulting in an increase in a rate of data packet transfer over that if the time diversity were implemented, because the OFDM signals that are transmitted over multiple ones of the transmitters are independent of each other for the spatial diversity and correspond to each other for the time diversity (see figures 3 and 6)

Regarding claim 28, Heath discloses classifying the sub-carriers into two groups, one of the two groups being indicative of time diversity and the other of the two groups being indicative of spatial diversity, determining a modulation scheme on each of the classified sub-carriers based on an estimated ratio selected from a further group consisting of a carrier to interference ratio and a signal to noise ratio (see figures 3 and 6; col. 4 line 4-8; and col. 8 line 65 to col. 9 line 5).

Regarding claim 29, Heath discloses a method for use with an adaptive orthogonal frequency division-multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a duration, the OFDM frame having data packets and a plurality of OFDM slots, each of the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the method comprising:

directing transmission and reception in accordance with OFDM by using controllers, the controllers including those associated with the reception responding to receipt of the OFDM signal by making a determination as to whether time diversity or

spatial diversity should be used for subsequent transmissions and transmits a feedback signal indicative of that determination, an implementation of the time diversity resulting in a better robustness to counter signal fading than if the spatial diversity were implemented and an implementation of spatial diversity resulting in an increase in a rate of data packet transfer over that if the time diversity were implemented, because the OFDM signals that are transmitted over multiple ones of the transmitters are independent of each other for the spatial diversity and correspond to each other for the time diversity, the controllers associated with the reception directing that transmission of at least one feedback signal occur that reflects the determination, the controllers including those associated with the transmission that respond to receipt of the feedback signal to direct an encoder to assign constellation points to the sub-carriers in accordance with a channel condition so as to classify each of the sub-carriers into one of two groups, the encoder including a space time transmitter diversity (STTD) encoder and a spatial multiplexing (SM) encoder, the STTD encoder being arranged to encode the sub-carriers classified in one of the groups in accordance with the time diversity and the SM encoder being arranged to encode the sub-carriers classified in the other of the groups in accordance with the spatial diversity (see figures 3-6).

Regarding claim 36, Heath discloses determining a modulation scheme on each of the sub-carriers based on an estimated ratio selected from a further group consisting of a carrier to interference ratio and a signal to noise ratio (see figures 3 and 6 and col. 8 line 65 to col. 9 line 5).

***Allowable Subject Matter***

Claims 2-8, 13-19, 22, 24-25, 30-35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Conclusion***

**Any response to this action should be mailed to:**

Commissioner of Patents and Trademarks

Washington, D.C. 20231

**or faxed to:**

(703) 872-9314, (for formal communications intended for entry)

**Or:**

Hand-delivered responses should be brought to Crystal Park II, 2021 Crystal Drive, Arlington, VA., Sixth Floor (Receptionist).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Bob A. Phunkulh** whose telephone number is **(703) 308-8251.** The examiner can normally be reached on Monday-Friday from 8:00 A.M. to 4:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor **Douglas W. Olms**, can be reach on **(703) 305-4703.** The fax phone number for this group is **(703) 872-9314.**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

**Bob A. Phunkulh**

*TC 2600*
*Art Unit 2661*
*July 12, 2004*